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EFFECT OF MINIMAL TEMPERATURE ON AXILLARY BUD DEVELOPMENT OF UPLAND COTTON

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SUMMARY

Two varieties of cotton differing in degree of determinate-indeterminate habit were grown in a warm (85 to 90° F.) and cool (65 to 70° F.) sections of a greenhouse. The nodal site of the first fruiting branch was unchanged by growth habit or temperature. Lower temperature depressed primarily the rate of growth of vegetative and reproductive parts, and appeared to have little effect on the differentiation of fruiting branches or flower buds. Although these results are for continuous temperature conditions, similar responses are noted frequently under field conditions early in the growing season.

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The effect of temperature on axillary bud development, particularly the development of fruiting branches of Upland cotton, has not been fully clarified. Eaton (1) reported that only vegetative growth occurred during low night temperatures, and implied in other reports (2,3) that with temperatures below 80° F., only rudimentary fruiting branches develop if fruiting branches develop at all. More recently, Sowell and Rouse (5) reported that squaring, flowering and growth occurred satisfactorily in day temperatures of 72° F. and night temperatures of 62° F. However, they observed a high rate of shedding of young bolls under these conditions. Pollination by pollen from plants grown under more optimum conditions did not reduce the amount of shedding.

The purpose of this report is to show the effect of minimal temperature on lateral bud development and on the nodal position of the first fruiting branch for an indeterminate and a determinate variety of cotton.

Seed of Hi-Bred, an early, determinate variety, and of Acala 1517C, a later, indeterminate variety, were planted in 4-gallon jars containing a mixture of loam, sand and rotted manure. The temperature during germination and emergence was kept at 85 to 90° F. Twenty plants of each variety were transferred at the first true leaf stage to a section of the greenhouse in which temperature was thermostatically controlled at 65 to 70° F. The remaining plants were left in the section where temperature was controlled at 85 to 90° F. The two groups of plants were placed randomly in the same relative position in the respective sections of the greenhouse. Weekly records of number of nodes and fruiting branches were kept for all lots. Random plants were harvested at intervals for dry weight determinations.

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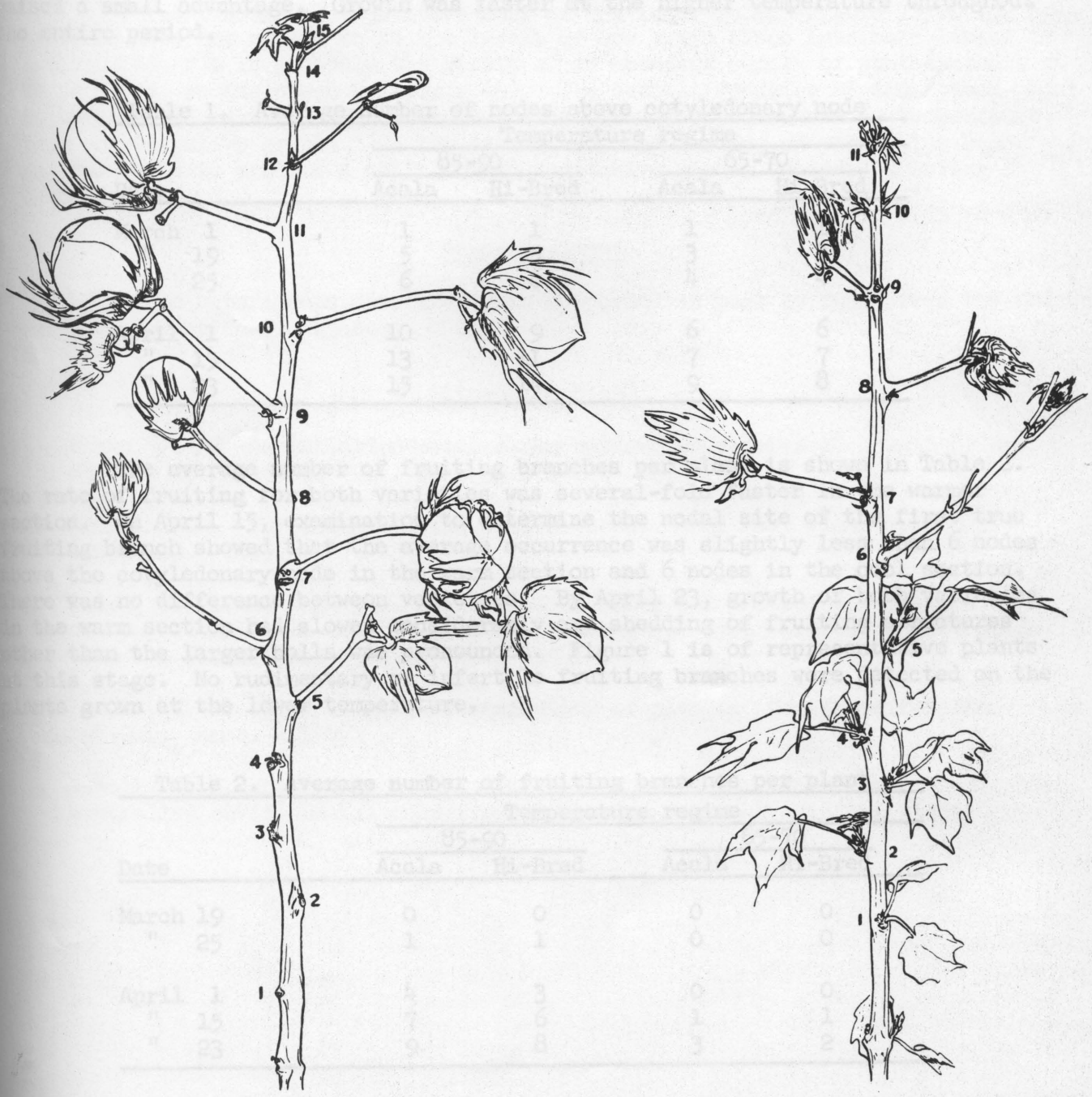

Figure 1. Cotton plants with leaves removed to show bud development. The plant on the left was grown in a temperature range of 85 to 90° F; the one on the right at 65 to 70° F. The first fruiting branch occurred on both plants at node 7. The branches below node 7 are vegetative branches in that the peduncle of the flower bud or fruit was attached to a very short (in this case) second order branch.

Table 1 records the average number of nodes produced per plant from March 1 until April 23. Growth in number of nodes and dry weights accumulated were similar for both varieties at either temperature although the indeterminate cotton gained a small advantage. Growth was faster at the higher temperature throughout the entire period.

Table 1. Average number of nodes above cotyledonary node

	Temperature regime			
	85-90		65-70	
Date	Acala	Hi-Bred	Acala	Hi-Bred
March 1	1	1	1	1
" 19	5	5	3	3
" 25	6	6	4	4
April 1	10	9	6	6
" 15	13	11	7	7
" 23	15	14	9	8

The average number of fruiting branches per plant is shown in Table 2. The rate of fruiting for both varieties was several-fold faster in the warmer section. On April 15, examination to determine the nodal site of the first true fruiting branch showed that the average occurrence was slightly less than 6 nodes above the cotyledonary node in the warm section and 6 nodes in the cool section. There was no difference between varieties. By April 23, growth of both varieties in the warm section had slowed considerably and shedding of fruiting structures other than the larger bolls was pronounced. Figure 1 is of representative plants at this stage. No rudimentary or infertile fruiting branches were detected on the plants grown at the lower temperature.

Table 2. Average number of fruiting branches per plant

	Temperature regime			
	85-90		65-70	
Date	Acala	Hi-Bred	Acala	Hi-Bred
March 19	0	0	0	0
" 25	1	1	0	0
April 1	4	3	0	0
" 15	7	6	1	1
" 23	9	8	3	2

Figure 1 and Tables 1 and 2 show that fruiting branches developed at the same nodes in both temperature intervals, and that the squares produced at the lower temperature were normal and continued to grow. Thus, instead of affecting the differentiation of buds as reported by Eaton (3), the low temperature reduced growth rates. If young boll shedding is pronounced at low temperature, as reported by Sowell and Rouse (5), only vegetative growth is manifested. This condition is not due to incomplete differentiation, but to failure in reproductive growth reactions.

The forcing of vegetative buds at the lower nodes (Figure 1) at low temperature does not appear to be the result of low auxin since internode length is not reduced, but is probably the result of an abundant supply of photosynthate at these sites, as explained by Loomis (4). The overall reaction of the cotton plant to temperature extremes indicates that fruit growth depends more on temperature than on vegetative growth. On the other hand, the forcing of vegetative buds, per se, seems to promote a shift toward vegetative growth as does suckering in tomatoes.

Acknowledgment

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Literature Cited

1. Eaton, F. M. Assimilation-respiration balance as related to length of day studies in soybeans. Bot. Gaz. 57:311-21. 1924.

2. Eaton, F. M. Physiology of the cotton plant. Ann. Rev. Plant Physiol. 6:299-328. 1955.

3. Eaton, F. M. and Ergle, D. R. Effect of shade and partial defoliation on carbohydrate levels and the growth, fruiting and fiber properties of cotton plants. Plant Physiol. 29:39-49. 1954.

4. Loomis, W. E. Growth and differentiation of plants. Growth correlation 197-218. Ames. 1953.

5. Sowell, W. F. and Rouse, R. D. Growth and fruiting of the cotton plant under controlled environmental condition. Agronomy Jour. 48:581-582. 1956.

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